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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/696,151	10/29/2003	Kangguo Cheng	FIS920030311US1	5490
7590	09/28/2004			EXAMINER LANDAU, MATTHEW C
H. Daniel Schnurmann IBM Corporation Dept. 18G, Building 300-482 2070 Route 52 Hopewell Junction, NY 12533			ART UNIT 2815	PAPER NUMBER

DATE MAILED: 09/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/696,151	CHENG ET AL.	
	Examiner Matthew Landau	Art Unit 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on _____.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-20 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 29 October 2003 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>4/5/2004</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____. |

DETAILED ACTION

Claim Objections

Claims 11 and 15 are objected to because of the following informalities:

Regarding claim 11, the limitation “the strap is has” should be changed to read, “the strap [[is]] has”.

Regarding claim 15, there is insufficient antecedent basis for the limitation “the node poly element”. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Mandelman et al. (US Pat. 2002/0105019, hereinafter Mandelman).

Regarding claims 1-3, Figure 6C and 6M of Mandelman disclose a DRAM cell comprising: a semiconductor substrate 10; a trench 16 extending into the substrate; a cell capacitor disposed in a bottom portion of the trench (paragraph [0051]); a cell transistor 24/32/36 disposed in a top portion of the trench above the cell capacitor; a node conducting element (upper portion of 22) connecting the cell capacitor to the cell transistor; and a collar 18 disposed about the node conducting element between the cell transistor and the cell capacitor; wherein: the

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collar is disposed in the substrate, wholly outside of the trench, between the cell capacitor and the cell transistor.

Regarding claims 4 and 5, Figure 6M of Mandelman discloses a strap 26 disposed between the node conducting element and the cell transistor, which is self-aligned with the collar.

Regarding claim 6, Figure 6M of Mandelman discloses a strap 26 disposed in the trench at substantially the same depth as the collar. Note that the strap and collar 18 are in contact. Therefore, at least the contact portions are at the same depth, and the two elements can be considered to be at substantially the same depth.

Regarding claims 7, 8, 11, and 20, Figures 6M of Mandelman discloses a strap 26 disposed in the trench and having a periphery; and the collar 18 is laterally adjacent and surrounds the periphery of the buried strap. As shown in Figures 6M and Figure 2 (showing the out-diffused region 24 which corresponds to the strap), the strap is formed on only one side of the trench, in an upper portion of the collar (see also paragraph [0054]), extending around the circumference of the trench. Therefore, it can be considered that the collar is laterally adjacent and surrounds the periphery of the buried strap, wherein the lateral direction is the direction around the circumference of the cylindrical trench.

Regarding claim 9, Figures 6C and 6M of Mandelman disclose a DRAM cell comprising: a semiconductor substrate 10; a trench 16 extending into the substrate; a cell capacitor disposed in a bottom portion of the trench (paragraph [0051]); a cell transistor 24/32/36 disposed in a top portion of the trench above the cell capacitor; a node conducting element (upper portion of 22) connecting the cell capacitor to the cell transistor; and a collar 18 disposed about the node

conducting element between the cell transistor and the cell capacitor; and a strap 26; wherein the strap is embedded into a top surface of the collar (paragraph [0054]).

Regarding claim 10, Figure 6M of Mandelman discloses the strap extends no higher than the collar.

Regarding claims 12-14, Figures 6A-6M of Mandelman disclose a method of forming DRAM cells, comprising: forming trenches 16 in a semiconductor substrate 10; forming cell capacitors in a bottom portion of the trench (paragraph [0051]); forming cell transistors 24/32/36 in a top portion of the trench; and for each DRAM cell, providing a collar 18 between the cell capacitor and the cell transistor, the collar being disposed in the substrate, wholly outside of the trench.

Regarding claims 15 and 16, Figures 6A-6M of Mandelman disclose for each DRAM cell, providing a node conducting element (upper portion of 22) between the cell capacitor and the cell transistor; wherein: the collar is disposed laterally adjacent and laterally surrounds the node poly element.

Regarding claims 17 and 18, Figures 6A-6M of Mandelman disclose for each DRAM cell, providing a node conducting element (upper portion of 22) between the cell capacitor and the cell transistor; and a strap 26 disposed between the node conducting element and the cell transistor, wherein the strap is self-aligned with the collar.

Regarding claim 19, Figures 6A-6M of Mandelman disclose a providing strap 26 disposed in the trench at substantially the same depth as the collar. Note that the strap and collar 18 are in contact. Therefore, at least the contact portions are at the same depth, and the two elements can be considered to be at substantially the same depth.

Claim Rejections - 35 USC § 103

Claims 1-9 and 11-20 rejected under 35 U.S.C. 102(a) as anticipated by Tews et al. (US Pat. 6,599,798, hereinafter Tews) or, in the alternative, under 35 U.S.C. 103(a) as obvious over Tews in view of the admitted prior art.

Regarding claims 1-3 and 12-14, Figure 12 of Tews discloses a DRAM cell comprising: a semiconductor substrate; a trench extending into the substrate; a cell capacitor disposed in a bottom portion of the trench; a cell transistor (col. 5, lines 20-22) disposed in a top portion of the trench above the cell capacitor; a node conducting element (poly in trench, col. 5, lines 3-6); and a collar disposed about the node conducting element (col. 5, lines 5-7); wherein: the collar is disposed in the substrate, wholly outside of the trench, between the cell capacitor and the cell transistor. Tews discloses a vertical transistor is formed after the structure of Fig. 12 is completed (col. 5, lines 20-22). Therefore, it is believed that the node conducting element will connect the cell capacitor to the cell transistor through outdiffusion region 30 (which forms the source/drain of the transistor). If for some reason this is found to not be inherent, it would certainly be obvious to have the node conducting element connecting the cell capacitor to the cell transistor as shown in Figure 1 of the instant application (prior art) for the purpose of fabricating a functional DRAM device. Regarding claims 12-14, Figures 2-12 also disclose a method of making the device.

Regarding claims 4, 5, and 18, Figure 12 of Tews discloses a strap 28 disposed between the node conducting element and the cell transistor, wherein the strap is self-aligned with the collar.

Regarding claims 6 and 19, Figure 12 of Tews discloses a strap 28 disposed in the trench at substantially the same depth as the collar.

Regarding claims 7 and 20, Figure 12 of Tews discloses a strap 28 disposed in the trench and laterally surrounded by the collar.

Regarding claim 8, Figure 12 of Tews discloses a strap 28 disposed in the trench and having a periphery; and the collar is laterally adjacent and surrounds the periphery of the buried strap.

Regarding claim 9, Figure 12 of Tews discloses a DRAM cell comprising: a semiconductor substrate; a trench extending into the substrate; a cell capacitor disposed in a bottom portion of the trench; a cell transistor (col. 5, lines 20-22) disposed in a top portion of the trench above the cell capacitor; a node conducting element (poly in trench, col. 5, lines 3-6); and a collar disposed about the node conducting element (col. 5, lines 5-7); a strap 28; wherein: the strap is embedded into a top surface of the collar. Tews discloses a vertical transistor is formed after the structure of Fig. 12 is completed (col. 5, lines 20-22). Therefore, it is believed that the node conducting element will connect the cell capacitor to the cell transistor through outdiffusion region 30 (which forms the source/drain of the transistor). If for some reason this is found to not be inherent, it would certainly be obvious to have the node conducting element connecting the cell capacitor to the cell transistor as shown in Figure 1 of the instant application (prior art) for the purpose of fabricating a functional DRAM device.

Regarding claim 11, Figure 12 of Tews discloses the strap has a periphery, which is laterally surrounded by the collar.

Regarding claims 15 and 16, Figure 12 of Tews discloses a node conducting element between the cell capacitor and the cell transistor; wherein: the collar is disposed laterally adjacent to and surrounds a periphery of the node poly element.

Regarding claim 17, Figure 12 of Tews discloses a strap 28 between the node conducting element and the cell transistor.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (571) 272-1731.

The examiner can normally be reached from 8:30 AM - 5:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



Matthew C. Landau

TOM THOMAS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER

Examiner

September 26, 2004